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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/863,503	05/23/2001	Hiroshi Akita	CSC-029	9374

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EXAMINER
ALEJANDRO, RAYMOND

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 07/17/2003

8

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/863,503	AKITA, HIROSHI	
	Examiner	Art Unit	
	Raymond Alejandro	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 June 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) *1-6 and 13-18* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *7-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 May 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of claims 7-12 in Paper No. 7 is acknowledged.

Priority

2. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on 08/17/01 (paper # 2) was considered by the examiner.

Drawings

4. Figures 5-6 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

5. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet *within the range of 50 to 150 words. It is important that the abstract not exceed*

150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

6. The preliminary amendment filed 09/14/01 does not introduce new matter into the disclosure. The preliminary amendment only inserted information related to the claim for foreign priority.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 7-8 and 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki 5346780 in view of Savinell et al 5525436.

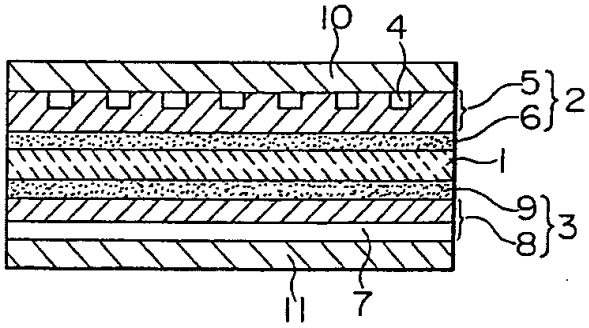
The instant claims are directed to a fuel cell wherein the disclosed inventive concept comprises the specific membrane-equipped composite electrolyte. Other limitations include the liquid electrolyte and monomer unit; the cross-linking agent; and the polymer.

With respect to claim 7:

Suzuki discloses a fuel cell comprising a pair of gas-diffusion electrodes provided with a porous catalyst layer and an acidic electrolyte layer held by the pair of gas-diffusion electrodes (ABSTRACT). **Figure 1** below illustrates a phosphoric acid fuel cell including a cell unit comprising an electrolyte layer 1 which is a porous electrolyte-retaining member such as a

porous substance retaining phosphoric acid (H_3PO_4) as an acidic electrolyte (*the matrix impregnated with phosphoric acid*) (COL 4, lines 56-64). The electrolyte layer is held by a pair of gas-diffusion electrodes i.e. a cathode 2 and an anode 3 (COL 4, lines 56-64). The cathode is composed of a gas feed layer 5 (*it is noted that the gas feed layer serves as the gas diffusion layer*) and a catalyst layer 6. The anode 3 is composed of a gas feed layer 8 (*it is noted that the gas feed layer serves as the gas diffusion layer*) and a catalyst layer 9 (COL 4, lines 64-68). It is also disclosed that the phosphoric acid (H_3PO_4) is in liquid phase (COL 7, lines 62-63).

FIG. 1



Examiner's note: *it is noted that the transitional phrase "composed of" (all occurrences) is construed as a open-ended phrase and therefore does not exclude other components.*

With respect to claim 8 and 11:

Suzuki discloses that the electrolyte is phosphoric acid in liquid phase (COL 4, lines 56-64/ COL 7, lines 62-63).

Suzuki discloses a phosphoric acid fuel cell according to the foregoing. However, Suzuki does not disclose the electrolyte matrix having the surface coated with a cross-linked polymer membrane and the membrane composed of a basic polymer having a secondary amine monomer.

With respect to claim 7 and 10:

Savinell et al disclose a proton conducting polymer used as membranes, the polymer being basic polymer complexed with a strong acid (ABSTRACT/ COL 2, lines 50-67). Savinell et al teach the use of such membranes in acid fuel cells. Savinell et al discloses the particular use of polybenzimidazole as a suitable polymer electrolyte membrane (ABSTRACT/ COL 2, lines 50-67). It is also disclosed that the polybenzimidazole is doped with a strong acid, such as phosphoric acid or sulfuric acid (COL 2, lines 63-67).

Savinell et al disclose that those polymers contemplated for use in his invention which demonstrate solubility in dilute acid may be made more stable by cross-linking in place in the film by any one of a number of known cross-linking techniques (COL 5, lines 45-50). *Thus, the protective membrane or coating is formed by cross-linking the polymer for constructing the matrix.*

Examiner's note: *in this regard, it is noted that applicant admits or discloses throughout his specification that the protective membrane is formed by cross-linking the polymer for constructing the matrix. Attention is directed to the following section of applicant's specification: 1) (applicant's specification, page 14, lines 19-24) "the protective membrane composed of cross-linked product can be easily formed by cross-linking the surface of the matrix"; 2) (applicant's specification, page 16, lines 10-12) "the protective membrane composed of crosslinked product is formed by cross-linking a surface portion of the polymer for constructing the matrix"; 3) (applicant's specification, page 19, lines 18-21) "the protective membrane-equipped composite electrolyte is constructed as having the protective membrane composed of cross-linked product on its surface"; 4) (applicant's specification, page 24, lines 9-*

15) "preparing a cross-linked product by cross-linking a surface portion of the polymer for constructing the matrix to form a protective membrane composed of cross-linked product"; 5) (applicant's specification, page 25, lines 20-27) "when the matrix is composed of the polymer, the protective membrane composed of cross-linked product can be conveniently formed with ease by reacting the matrix itself and the cross-linking agent with each other. As a result, the protective membrane-equipped composite electrolyte is obtained, in which the surface of the composite electrolyte is coated with the protective membrane composed of cross-linked product".

Thus, when the polymer acting as the electrolyte matrix is cross-linked, the protective membrane, coating or film is formed on the matrix surface.

With respect to claim 8 and 11:

Savinell et al discloses the particular use of polybenzimidazole as a suitable polymer electrolyte membrane (ABSTRACT/ COL 2, lines 50-67). *Thus, the membrane is composed of a basic polymer having a structural unit of monomer of secondary amine.* It is also disclosed that the polybenzimidazole is doped with a strong acid, such as phosphoric acid or sulfuric acid (COL 2, lines 63-67).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to make the electrolyte matrix having the surface coated with a crosslinked polymer membrane of Savinell et al in the electrolyte matrix of Suzuki because Savinell et al disclose that those polymers contemplated for use as electrolyte matrix which demonstrate solubility in dilute acid may be made more stable by cross-linking in place in the film by any one

of a number of known cross-linking techniques. Accordingly, Savinell et al directly teach the use of cross-linked polymers to enhance stability. Therefore, the protective membrane in the electrolyte matrix is obtained when the polymer acting as the electrolyte matrix is cross-linked as instantly claimed.

As to the membrane composed of a basic polymer having a secondary amine monomer, it would have been obvious to one skilled in the art at the time the invention was made to make the membrane composed of a basic polymer having a secondary amine monomer of Savinell et al in the electrolyte of Suzuki as Savinell et al teach that polybenzimidazole (a basic polymer having a secondary amine monomer) is of particular interest because it can be doped with a strong acid as well as because these polymers film exhibit excellent oxidative and thermal stability; these properties being further enhanced by the acid nature of the polymer. Further, it has been found that films comprising polymers containing basic groups that can form complexes with stable acids provide a viable alternative as proton exchange membrane matrix or medium, being polybenzimidazoles an example of a suitable polymer for this purpose. Moreover, these polymers require low water activity, thus avoiding operating temperature limits due to the boiling point of water; and showing capability to operate at elevated temperatures, thereby reducing the potential for anode/cathode poisoning. Further, these polymers do not suffer significantly from methanol cross-over because of low methanol swelling with methanol vapor and high glass transition temperatures. Hence, it provides a solid polymer to be used as an electrolyte matrix which is stable and retains reasonable ionic conductivity and does not suffer from known problems associated with catalyst stability and activity.

9. Claims 9 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki 5346780 in view of Savinell et al 5525436 as applied to claims 8 and 12 above, and further in view of the WO 00/44816 publication.

Suzuki and Savinell et al are applied, argued and incorporated herein for the reasons above. In addition, Suzuki and Savinell et al do not disclose the specific cross-linking agent containing two or more isocyanate groups.

With respect to claims 9 and 12:

The WO'816 publication discloses bridged polymers membrane for fuel cells (ABSTRACT) wherein the basic polymer may be polybenzimidazole (PAGE 3, lines 11-12) and the bridging agent (*the cross-linking agent*) has at least two isocynate groups in the molecule thereof (PAGE 3, lines 5-6).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific cross-linking agent containing two or more isocyanate groups of the WO'816 publication to cross-link the polymer electrolyte matrix of both Suzuki and Savinell et al as the WO'816 disclose that by bridging the basic polymer using the specified bridging agent in the shaped membrane the mechanical strength of the polymer electrolyte is improved. Thus, by employing the specified cross-linking agent and obtained a cross-linked product as part of the polymer electrolyte membrane, a polymer having a sufficient degree of mechanical strength is achieved, thereby reducing its swelling property when immersed in water or aqueous solution.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (703) 306-3326. The examiner can normally be reached on Monday-Thursday (8:30 am - 7:00 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (703) 308-2383. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Raymond Alejandro
Examiner
Art Unit 1745